Institut für Meereskunde
an der Universität Kiel

Date: 22.11.2003

Cruise Report

Compiled by: T.J. Müller

F.S.Poseidon **Cruise No.: P306**

Dates of Cruise: 09.11-27.11.2003

Areas of Research: Physical oceanography

Port Calls: Lisbon: 06.11.-12.11.2003
Bremerhaven : 27.11.2003-06.03.2004

Institute: Institut für Meereskunde, Kiel

Chief Scientist: T.J. Müller

Number of Scientists: 5

Projects: ANIMATE

Cruise Report

This cruise report consists of 10 pages including cover:

1. Scientific crew

Name	Institute	
Müller, Thomas J.	IFMK	Chief scientist
Begler, Christian	IFMK	Student
Busack, Michael	IFMK	Technician
Koy, Uwe	IFMK	Technician
Wigham, Ben	SOC	Biology
Total	**5**	

Institutions:
IFMK: Institut für Meereskunde, Kiel, Germany
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2. Research programme

Cruises P306 was aimed at serving on short notice the time series stations southwest of Ireland in the Porcupine Abyssal Plain (PAP site) within the ANIMATE programme funded by the European Commission.

Within ANIMATE, three open ocean time series stations have been set up north of the Canary Islands (ESTOC), west of Ireland in the Porcupine Abyssal Plain (PAP, Fig 1) and southeast of Greenland in the Central Irminger Sea (CIS) since early 2002. All these stations are equipped with recently developed sensors to measure CO2-flux, the contents of nutrients, and fluorescence as parameter for chlorophyll *a* in the upper 10 m to 90 m. Also, an inductive-modem based under-water data transfer and a small surface buoy is used to transmit near-real-time data of temperature and salinity (MicroCat SBE37, MC) from the upper 1000 m through satellite for open use. Technical problems had caused breaks in the upper parts of the telemetry mooring PAP2-01 earlier this year. Two drifting parts were recovered later in 2003, however, the rest of the mooring with some MCs could not be located nor recovered at its launch position during POSEIDON cruise P300/1 in July 2003. Instead, spare MicroCats to measure temperature and salinity were incorporated into the chemical sensor mooring PAP1-02 that replaced PAP2-01 during POSEIDON cruise P300/1 in July 2003. Present cruise P306 was aimed to re-implement station PAP, and on this occasion to exchange a lander (BATHYSNAP) of the Southampton Oceanographic Centre that was deployed during P300/1.

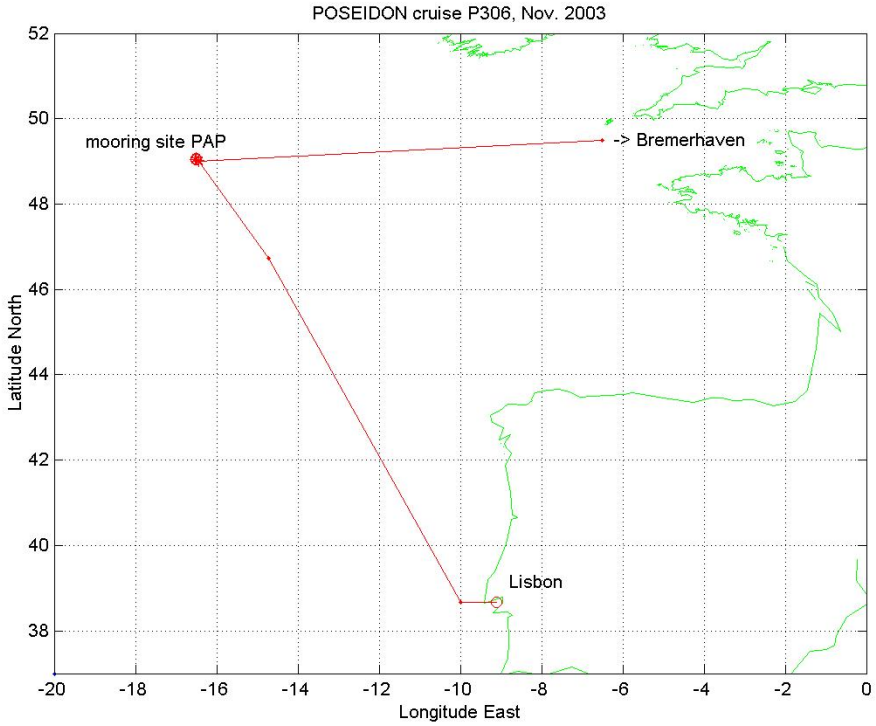

Fig. 2.1: *POSEIDON cruise P306, November 2003, track from Lisbon via mooring site PAP to the English Channel.*

3. Narrative of cruise with technical details

On 08th November, the five members of the scientific crew embarked in Lisbon. Due to a delay of the container with scientific equipment, sailing was delayed by 3 days from 09th to 12th November. On 12th November in the evening, all equipment was onboard, and POSEIDON sailed for cruise P306 heading for position of the PAP moorings around 49°00'N, 016°30'W. On the way, we tested 5 acoustic releasers on the wire down to 1000 m in three casts. On 16th November in the morning, we reached the position of the first mooring to be recovered. Under rather fair wheather forecast, we decided to use the next three days to perform the cruises core programme:

16th November

- 08:09, no acoustic contact to releaser of mooring PAP1-02/frame; release sent several times; search for mooring using the watchdog ARGOS signal.
- 12:15, top buoy sighted
- 16:05, all parts safely on deck with 7 MicroCats, SAMI CO2 senors, nutrient NASE-2 sensor and fluorescence HS2 sensor.
- download and check recorded data.

17th November

- 06:46, acoustic contact to BATHYSNAP-2 lander launched during P300/1 in July 2003; release command sent; 2 h estimated time to reach the surface.
- 08:36, BATHYSNAP lander sighted at surface, and taken safely on deck; camera data to be read at SOC later after the cruise.
- 11:00, start launch mooring PAP2-03/tele with 7 MicroCats for near on-line telemetry through the ARGOS system and additional 5 TP recorders; telemetry working after settling
- 18:00, close to PAP2-03/tele mooring CTD/rosette cast to 1200 dbar; salinity samples for indirect intermediate calibration of the 7 MCs recovered and relaunched.
- 20:00, close to PAP1-03/frame nominal position CTD/rosette cast to 300 dbar; HS2 sensor (depth rating 300 dbar) and 1 MicroCat attached to rosette; samples for salinity, nutrient, CO2 and Cl-a calibration.

18th November

- 06:45, 2nd trial to communicate acoustically to BATHYSNAP-01, launched during DISCOVERY cruise D266 in October 2002 and which could not be communicated to in a 1st trial during P300/1 in July 2003; no success; release commands sent; visual search from 08:15 on; no visual and no acoustic contact at all.
- 09:21 stop visual and acoustic search for BATHYSNAP-1.
- 11:05, start launch mooring PAP1-03/frame with 1 MicroCat, NASE-2, SAMI, HS2 under increasing wind (up to 8 Bft) and high swell.
- 16:19, launch BATHYSNAP-3 lander.
- 16:34, start to follow diving of BATHYSNAP-3 down to the bottom (4835 m); from 4000 m on no further contact; trial to get into acoustic contact for another hour in case it would rise again; no contact; at 19:03 assume BATHYSNAP stays at the bottom.
- 19:30, finish repeated control of watchdog on PAP1-03/frame launched earlier the day; no contact; assume mooring is safe below the surface.

As the wheather forecast with Bft. 6-7 and high swell for the next 36 h forbade to drag for the rest of mooring telemetry mooring PAP2-01 that could not be located nor recovered during P300/1 in July 2003, we finished station work at 19:30 and started sailing towards Bremerhaven. On 23rd November we berthed in the 'Alter Fischereihafen'. The next ANIMATE PAP cruise is scheduled for March 2004.

4. Scientific report and first results

Scientific analysis to be performed at the Southampton Oceanography Centre, SOC.

5. Scientific equipment: moorings and instruments

5.1 Moorings

In the Porcupine Abyssal Plain, the time series station PAP was re-implemented (Tab 1). One mooring (PAP2) carries 7 MicroCats in the upper 1000 m which data are telemetered on-line through a surface buoy and the ARGOS system, and additional 5 TP recorders. The other mooring (CIS1) is sub-surface with a bio-chemical sensor package at 40 m depth (SAMI CO2, NASE-nutrients, HS2 fluorimeter, MicoCat CTD), a 300 kHz ADCP at 150 m looking upeards and a broad band ADCP at 152 m looking downwards.

For SOC, one lander (BATHYSNAP-2) was recovered and one (BATHYSNAP-3) launched.

Tab. 1: POSEIDON cruise POS306: moorings

ID	Latitude Longitude Water depth (corrected)	Date and cruise of launching	Date and cruise of recovery	Instrumentation	Remarks
PAP1-02/frame	48°59.75'N 016°26.69'W 4835 m (corr.)	12-JUL-2003 POS300/1	16-NOV-2003 POS306	7 MC, SAMI, NASE-2, HS-2	
BATHYSNAP-2	49°00.99'N 016°26.76'W 4835 m (corr.)	P300/1	17-NOV-2003 POS306	Camera	
PAP2-03/ tele	49°04.53'N 016°29.78'W 4838 m (corr)	17-NOV-2003 POS306	May/June 2004 C DARWIN scheduled	7 MC (tele), 5 TP	
PAP1-01/frame	49°02.50'N 016°31.60'W 4835 m (corr.)	18-NOV-2003 POS306	May/June 2004 C DARWIN scheduled	MC, SAMI, NASE-2, HS-2	
BATHYSNAP-3	49°59.97'N 016°27.07'W 4835 m (corr.)	18-NOV-2003 POS306	May/June 2004 C DARWIN scheduled	Camera	

Abbreviations:
MC: MicroCat self-recording CTD, data telemetered by inductive modem
SAMI: CO2 self recording sensor
NASE-2: nutrient self recording sensor
HS2: fluorescence self recording sensor

5.2 CTD and rosette bottle sampling

5.2.1 CTD and bottle salinity

For the CTD-measurements, a SeaBird SBE 911 (IFMK internal code SBE3) was used. Sensor calibration and data processing follow the procedure described by Müller in Grasshoff et al. (1999). Calibration for pressure and temperature sensors was performed at IFM Kiel April 2003 respectively. Water samples were taken for CTD salinity calibration. The samples were analysed on a Guildline AUTOSAL model 8400A later at IFMK using IAPSO standard seawater batch P137 (K15=099995, S=34.9980) for instrumental calibration. The estimated accuracy of individual bottle salinities after removing outliers is better than 0.003 on the ISS78 scale.

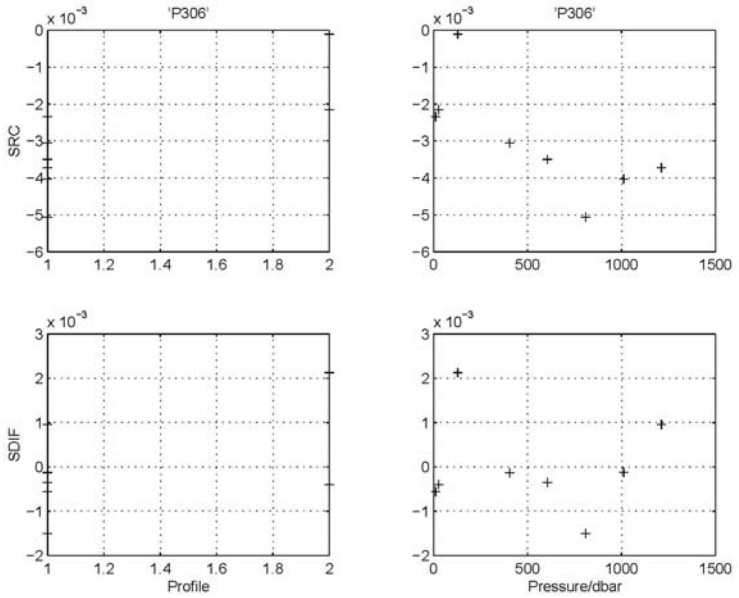

Fig. 5.1.1.1: in-situ salinity calibration. SRC (upper panel) is pre-calibration correction; SDIF (lower panel) is the final error SDIF between bottle (reference) and calbrated CTD salinity after applying a linear correction to conductivity (Müller, 1998); the overall standard deviation of SDIF is less 0.002 on the ISS78 scale.

Post-cruise laboratory calibration of the pressure and temperature sensors was not possible before publishing this report. Therefore, the expected accuracies of these sensors (as known from observed possible drifts in the calibration history) maybe less than usual, 0.002 K in temperature and 3 dbar at full pressure scale, respectively. Salinity calibration as compared to bottle salinities will not be affected by these small scale uncertainties in pressure and temperature accuracies; also, errors due to non-stable laboratory temperature are expected to be removed by averaging the calibration over the two stations. Thus, final accuracy it is expected to be better 0.003 on the IPSS78-scale.

5.2.2 Sampling for nutrients, CO_2 and chlorophyll *a* at PAP

All samples were taken according to JGOFS standards (Grasshoff et al., 1999). Those for nutrients were deep frozen (-20°C) for later analysis. To CO_2, samples, $HgCl_2$ was added, then samples were stored cool and dark. Water for Cl-*a* samples was filtered and stored deep frozen (-20°C) for later analysis. Samples were transferred to SOC, to IFMK and to the Instituto Canario de Ciencias Marinas ICCM through IFMK for sample analysis at ICCM (nutrients), chlorophyll (SOC) and CO_2 (IFMK).

5.3 Underway measurements

While underway data were used as they were indicated on-line on screen, no data were archived during this short-term-noted cruise.

5.3.1 Navigational data

An Ashtech made GG24 unit merges positionings from high rate GPS data with high precision GLONASS data. Three dimensional GPS data from an Ashtech ADU2 are used to estimate heading, pitch and roll. A check of the September 1997 antenna calibration while in port during a later cruise, between P261 and P262 in July 2000, gave no corrections.

Both, GG24 and ADU2 data are input for the standard vmADCP data acquisition and for the underway logging system PC-Log (see 5.3.2)

5.3.2 PC-Log

A PC-based programme package, PC-Log, is used to log consecutively the data streams from navigational units, the ship's meteorological sensors, the deep sea echosounder and from the thermosalinograph. Standard ouput format is binary, but ASCII transformation is an option .

5.3.3 Meteorological data

The meteorological sensors (wind speed and direction, temperature, humidity, surface air pressure, near surface water temperature) are set up and maintained by the German Wheather Sevice (DWD), Seewetterdienst, Hamburg, Germany. Data are transferred on a regular scale into the Global Telecommunication System (GTS) for analysis by WMO partners. The digital output is also transferred to the PC-Log system.The sensors were maintained early 2003 before Poseidon sailed from Kiel.

5.3.4 Deep sea echosounder

A 12 kHz echosounder by ELAC provides depth information, both as standard graph on paper and as digital output. The sound velocity converting travel times to sounding depths was 1500 m/s. The signal is corrected for the transducer‘s depth (4 m). The digital output was input to the PC-Log system.

5.3.5 Thermosalinograph

The digital output of the thermosalinograph raw data is transferred to the PC-Log system where it is converted to physical units for temperature and salinity. The accuracy is 0.05 K and 0.2 for temperature and salinity, respectively. Corrections with near surface CTD data while on station, improve the accuracy estimates to 0.02 K and 0.15 for temperature and salinity, respectively.

5.3.6 vmADCP

The vessel mounted ADCP usially used *en route*, was not implemented.

6. Additional remarks

Captain Lutz Mallon and his crew advised and helped during this cruise in the same professional way we had experienced during earlier cruises. In particular, bosun Joachim Mischker did a great job while launching mooring PAP1-03 under severe conditions. All members of the scientific party would like to achnowledge this.

The work at the time series station PAP is part of the ANIMATE project funded by the European Commission.

7. Appendices

A. Station list

8. References

Grasshoff, K., K. Kremling, M. Ehrhardt (editors): Methods of sea-water analysis; 3rd edition, Wiley VCH, 1999.

Appendix A: Station list

POSEIDON cruise 306, 09 NOV 2003 - 23 NOV 2003
Lisbon - Bremerhaven

Station and sample log

Status: 23-NOV-2003

List of abbreviations:
St : Station no.
C : CTD cast no., monotonically increasing during the cruise;
all casts to near bottom if not indicated else
Wd : Water Depth
Wl : length of wire, instrumental depth
It : Type of instrumentation or mooring or equipment with symbol
It
VXXX : 1 mooring
SBE3 : 2 SeaBird 911 CTD; IFMK code SBE3 with a 12x5 l bottle rosette from IFMH
TSG : 4 Ship's thermasalinograph, 4 m, made by Meerestechnik Elektronik, Kie, Germany
vADCP : 4 vessel mounted RDI ADCP, 150 KHz, 4 m, not installed
PC-LOG: 4 on-line log of GPS date, time, position, pitch & roll (ASHTEC GPS/GLONASS & ADU2),
near-surface T, S by TSG; meteorological data of the ship's meteorological sensors

Year 2003

Date UTC MM	DD	Time UTC hh	mm	St	C	Latitude GG	MM.MM	Longitude GGG	MM.MM	Wd m	Wl m	It	Instrument / Remarks
11	12	18	00	-9	-9	38	40	-009	07	-9	-9	2	sail from Lisbon; begin of P301
11	12	-9	-9	-9	-9	38	40	-010	00	-9	-9	4	WP Tejo
11	13	08	00	-9	-9	-99	-99	-099	-99	-9	-9	4	start PC-LOG
11	15	08	00	-9	-9	-99	-99	-099	-99	-9	-9	4	start TS-graph
11	15	08	03	-9	-9	46	43.55	-014	-43.62	4784	1000	4	test releaser
11	16	08	08	861	-9	48	59.75	-016	-26.69	4806	-9	1	PAP1-02/frame mooring recovery
11	17	06	39	862	-9	49	00.99	-016	-26.76	4803	-9	1	BATHYSNAP-2 recovery
11	17	11	00	863	-9	49	04.53	-016	-29.78	4804	-9	1	PAP2-03/tele mooring launched
11	17	18	10	864	1	49	04.14	-016	-30.60	4801	1221	2	SBE3/rosette, S
11	17	20	21	865	2	49	02.49	-016	-30.17	-9	307	2	SBE3/rosette, S, nuts, CO2, Cl-a
11	18	06	44	866	-9	49	00.21	-016	-26.78	-9	-9	1	BATHYSNAP-1, trial to recover
11	18	10	40	867	-9	49	02.50	-016	-31.60	4801	-9	1	PAP1-03/frame mooring launched
11	18	16	15	868	-9	48	59.97	-016	-27.07	4801	-9	1	BATHYSNAP-3 mooring launched
11	21	-9	-9	-9	-9	-99	-99	-099	-99	-9	-9	4	TSG off, PC-LOG off
11	-9	-9	-9	-9	-9	49	45	-006	-30	-9	-9	4	WP Scilly Islands
11	23	-9	-9	-9	-9	-99	-99	-099	-99	-9	-9	2	Bremerhaven